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EXAMINER

SMITH, JACKSON R

ART UNIT PAPER NUMBER

1709

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	04/06/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

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Office Action Summary	Application No. 10/762,479	Applicant(s) KIM ET AL.	
	Examiner Jack Smith	Art Unit 1709	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 1/23/04.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-14 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-14 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date 10/27/04.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: _____.

DETAILED ACTION

Claim Objections

1. Claims 6 and 13 are objected to because of the following informality:
inappropriate terminology is used.

In these claims the term "open-structured transition metal" refers to a type of metal and, therefore, cannot limit the type of metal oxide as specified in the claim. In order to examine the claim on its merits, the limitation has been interpreted as meaning that the metal oxide created by the method specified in claims 1 and 8 is to have an open or porous structure. Further, the limitation that the metal of the metal oxide is a "transition metal" is logically inconsistent with dependent claims 7 and 14. The latter claims list a series of metals for the oxide that include both Si and Al, neither of which are transition metals. Therefore, in order to examine the claim on its merits, this limitation has been interpreted as meaning that the metal of the metal oxide is preferably a transition metal, but may also be another type of elemental metal. Appropriate correction is required.

Claim Rejections - 35 USC § 112

2. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

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3. Claims 7 and 14 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

These claims are logically inconsistent with claims 6 and 13 on which they, respectively, depend. The series of metals for the oxide listed in claims 7 and 14 includes both Si and Al, neither of which are transition metals. Appropriate correction is required.

Claim Rejections - 35 USC § 102

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

5. Claims 1, 2, 5, 6, 8, 9, 12, 13 are rejected under 35 U.S.C. 102(b) as being anticipated by Park et al. (K.W. Park, K.S. Ahn, J.H. Choi, Y.C. Nah, Y.M. Kim, "Pt-WO_x electrode structure for thin-film fuel cells," Applied Physics Letters 81, (2002) 907-909).

As to claims 1 and 8, Park et al. disclose a method for fabricating a counter electrode (Pt-WO_x two-phase electrode, paragraph 2) the method comprising: co-sputtering platinum (Pt target material, paragraph 3) and a metal oxide (WO₃ target material, paragraph 3) as target materials onto a substrate

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(ITO coated transparent glass substrate, paragraph 3) as described in paragraph 3. The process forms a counter electrode (Pt-WO_x nanostructured alloy electrode, paragraph 2) that includes nanocrystalline platinum (nanosized Pt crystalline phase of 4-5 nm shown as the dark portions of the images in Figure 1 and discussed in paragraph 4). Finally, the method disclosed by Park et al. yields an amorphous metal oxide (amorphous, porous tungsten oxidative phase discussed in paragraph 4 and shown as the "relatively bright region" in the TEM image of the electrode in Figure 1).

Although the method disclosed in Park et al. is for the fabrication of an electrode for a Thin-film fuel cells and not explicitly for a dye-sensitized solar cell, the method disclosed provides an electrode suitable for the latter device without any modifications whatsoever. This preamble merely recites the purpose of the process and the intended use of the resulting structure, while the body of the claim does not depend on the preamble for completeness and the process steps and structural limitations are able to stand alone (see MPEP 2112.02).

6. As to claims 2 and 9, the metal oxide of Park et al. (i.e., amorphous tungsten oxide) has a refractive index of 2 or higher. This is evidenced by Gogova et al. . (D. Gogva, K. Gesheva, A. Szekeres and M. Sendova-Vassileva, "Structural and Optical Properties of CVD Thin Tungsten Oxide Films, " *Physica Status Solidi (a)* 176 (2) , (1999) 969 - 984) in Figure 8 (see refractive index for amorphous tungsten oxide unannealed and deposited at 200°C).

As to claims 5 and 12, the metal oxide of Park et al., i.e., amorphous tungsten oxide, has an open or porous structure (see the description of , "an amorphous, porous tungsten oxidative phase" in paragraph 4).

As to claims 6 and 13, the open-structured metal oxide of Park et al., i.e., amorphous tungsten oxide, contains the element tungsten which is a transition metal.

Claim Rejections - 35 USC § 103

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

8. Claims 1, 6, 7, 8, 13 and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Pruneanu et al. (S. Pruneanu, G. Mihailescu, E. Indrea, "Nanoporous Al₂O₃ membranes filled by platinum," Semiconductor Conference 2000, CAS 2000 Proceedings, International 2, (2000) 475-478) in view of Park et al.

As to claims 1 and 8, Pruneanu et al. disclose a method for fashioning an Al₂O₃/Pt composite "nanoelectrode" counter electrode for "electronic and photoelectronic devices" such as dye-sensitized solar cells (Introduction, paragraph 1). The method involves depositing Pt metal inside nanopores of

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Al₂O₃ electrochemically which creates nanocrystalline patches of Pt metal for the electrode. What Pruneanu et al. fail to disclose is a technique based on sputtering.

Park et al. disclose a method for fabricating a counter electrode (Pt-WO_x two-phase electrode, paragraph 2) the method comprising: co-sputtering platinum (Pt target material, paragraph 3) and a metal oxide (WO₃ target material, paragraph 3) as target materials onto a substrate (ITO coated transparent glass substrate, paragraph 3) as described in paragraph 3. The process forms a counter electrode (Pt-WO_x nanostructured alloy electrode, paragraph 2) that includes nanocrystalline platinum (nanosized Pt crystalline phase of 4-5 nm shown as the dark portions of the images in Figure 1 and discussed in paragraph 4). Finally, the method disclosed by Park et al. yields an amorphous metal oxide (amorphous, porous tungsten oxidative phase discussed in paragraph 4 and shown as the "relatively bright region" in the TEM image of the electrode in Figure 1). Park et al. explain, in paragraph 1, that such a sputtering process produces electrodes "physical and electrochemical properties" that are superior relative to other techniques. As to the latter, Park et al. specifically mention an "electrochemical deposition" similar to that used by Pruneanu et al. It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the method of Pruneanu et al. for creating a Al₂O₃/Pt electrodes by doing the same using the sputtering method of Park et al. in order to improve the physical and electrochemical properties of the electrode.

Although the method disclosed in Park et al. is for the fabrication of an electrode for a Thin-film fuel cells and not explicitly for a dye-sensitized solar cell, the method disclosed provides an electrode suitable for the latter device without any modifications whatsoever. In fact, the explicit mention of the use of the method disclosed in the instant application for a dye-sensitized solar is simply part of the preamble of the claim which is generally not accorded any patentable weight. This preamble merely recites the purpose of the process and the intended use of the resulting structure, while the body of the claim does not depend on the preamble for completeness and the process steps and structural limitations are able to stand alone (see MPEP 2112.02).

As to claims 6 and 13, the metal oxide of Pruneanu et al. is "nanoporous" (title) and, therefore, porous or open-structured.

As to claims 7 and 14, the metal oxide of Pruneanu et al. is Al_2O_3 which is an oxide of aluminum.

9. Claims 3, 4, 10, and 11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Park et al. in view of Vink et al. (T.J. Vink, W. Walrave, J.L.C. Daams, P.C. Baarslag, J.E.A.M. van den Meerakker, "On the homogeneity of sputter-deposited ITO films Part I. Stress and microstructure," Thin Solid Films 266 (1995) 145-151).

As to claims 3 and 10, the reference Park et al. discloses all the features of claims 1 and 8 above but fails to provide a metal oxide layer selected from oxides of titanium, chromium, zinc, copper, ruthenium, vanadium, tin and indium.

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Vink et al. disclose a sputtering method (paragraph 1 of the Experimental section) that uses two metal-oxide targets and is entirely compatible with that of Park et al. for sputter-depositing films for use in optoelectronic applications as a transparent conductor (Introduction, 1st paragraph). Neerinck et al. explain the advantages using the method to sputter-deposit amorphous films of indium tin oxide (low-temperature, LT, deposited amorphous ITO films) that have relatively low resistivity and high transmissivity to visible light (Introduction, 1st paragraph). It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the method of Park et al. by using the method of Vink et al. (i.e., by using the two metal oxide targets of Neerick et al. to sputter-deposit indium tin oxide) in order to decrease the resistivity and increase the transmissivity of the electrode. Doing so would form a counter-electrode that would include nanocrystalline platinum as well as an amorphous metal oxide layer composed of oxides of both tin and indium.

As to claims 4 and 11, the metal oxide of Vink et al. has an electrical resistivity of less than $10^{-2} \Omega \text{ cm}$ (Figure 1), which implies conductivity well in excess of 0.1 S/m.

Conclusion

10. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jack Smith whose telephone number is (571) 272-9814. The examiner can normally be reached on 7:30 a.m. - 5:00 p.m., Mon - Fri.

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Alexa Neckel can be reached on (571) 272-1446. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

JRS



BARBARA GILLIAM
PRIMARY EXAMINER